CHYLOUS AND CHYLIFORM EFFUSIONS INTO THE SEROUS SAC: WITH A CASE.[1]

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The subject of effusion of chyle, chyle-like and fatty fluids, has been especially investigated in this country by Busey, whose papers contain full studies of the early literature of the subject and important collections of cases. The paper read by Dr. Busey before this Society in 1889[2] contains a table of 33 collected cases of "effusion and accumulation of chyle and chyle-like, milky, fatty, and oily fluids in the peritoneal cavity," together with abstracts of 13 cases collated after the table was prepared. In Germany, Quincke (1875),[3] Bargebuhr (1893),[4] and again (1895),[5] Rotmann (1897),[6] Mutermilch (1902),[7] and others, have published valuable papers upon the subject.

To Quincke is due the credit of having first pointed out the distinction between chylous and chyliform effusions—hydrops chylosus and hydrops adiposus—while Bargebuhr recognized the important fact that a nice distinction between these two forms of effusion cannot in all cases be made, and that in some cases the presence of the chylous transudate and the chyliform exudate at the same time is by no means improbable—*gar nicht undenkbar sei.*

Bargebuhr collected 126 cases, including Busey's cases, reported between 1633 and 1894.

Rotmann's collection of 29 cases includes some that were overlooked by Bargebuhr and those published subsequently, making 155 in all to 1897. Of the latter 3 were personal observations made in Mosler's clinic. Since the date of Rotmann's paper many cases have been reported.

It is certain that the frequency of chylous and chyliform effusions is far greater than the literature indicates. The appearance of the fluid is striking, and at once arouses the attention of the trained observer; yet it presents in some cases a superficial resemblance to pus, which may mislead the physician whose attention has not been especially called to the subject. There are no means by which the nature of the effusion may be determined *intra vitam* except by the withdrawal of a portion of it. In many of the reported cases its presence was first recognized at the autopsy. The fact that cases occur much more frequently than the collected statistics indicate is evident upon the consideration of the experience of those who have written upon the subject. Senator saw 8 cases, Rotmann saw 5 cases at Greifswald in the course of two years, and I have seen in all 3 cases. Not all the cases by any means find their way into the literature, for the reason that many observers hesitate to report single cases and the cases which recover and those in which autopsy cannot be made are necessarily incomplete.

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[1] Read by title at the Twentieth Annual Meeting of the Association of American Physicians, Washington, D. C., May 16, 1905.

[2] Transactions of the Association of American Physicians, vol. iv. p. 76; The American Journal of the Medical Sciences, vol. xc. p. 373.

[3] Deutsches Archiv f. klin. Med., Bd. xvi. pp. 121-139.

[4] Ibid., Bd. li. pp. 161-192.

[5] Ibid., Bd. liv. pp. 410-441.

[6] Zeitschrift f. klin. Med., Bd. xxxi. pp. 416-441.

[7] Ibid., Bd. xlvi. pp. 123-134.

Rotmann's study of 155 cases shows the effusion to have been present in the abdomen in 104 cases, in the pleural cavity in 49 cases, and in the pericardium in 2 cases. In certain cases, as in that which forms the basis of this communication, the milky effusion has been found both above and below the diaphragm.

The pathological causes of milk-like effusion into the serous sacs are, in general: (1) trauma; (2) tuberculosis; (3) malignant disease; (4) filariasis; (5) thrombosis of the left subclavian vein; (6) disease of the liver; (7) syphilis.

The particular causes of such effusions into the peritoneal sac (*chylous ascites*) comprise those conditions which produce a solution of continuity in the vessel walls by injury, inflammation or extreme tension, or by transudation through the wall weakened by disease. Under this heading Rotmann has grouped the following special causes in the order of their frequency: Compression of the thoracic duct or the lymphatic vessels by glandular enlargements, neoplasms, etc., 17 cases; non-tuberculous peritonitis, 9; occlusion of the left subclavian vein, 6; excessive pressure, strain, cough, 5; peritoneal carcinoma, 5; filariasis, 3; occlusion of the thoracic duct, 3; occlusion in lymph glands, 3; occlusion of lymph vessels, 2; external pressure, 2; malignant lymphoma, 2; disease of the liver, 2; syphilis, 2; primary disease of the lymph vessels, angioma, 1; and calculus in the receptaculum chyli, 1.

The special causes of *chyliform effusions* into the peritoneal sac he groups as (*a*) due to fatty changes in cells, especially endothelial, and the cellular elements of new-growths—tuberculosis, 6; carcinoma, 5; cirrhosis of the liver, 3; cardiac disease, 2; sarcoma, 2; chronic non-tuberculous peritonitis, 1; and an apparently primary fatty degeneration of the endothelium, 1—and (*b*) an abnormal fatty condition of the blood—lipæmia, 1.

The special causes of *mixed forms* are, according to this observer, carcinoma, peritoneal, mesenteric, glandular, etc., 3, and tuberculous peritonitis, 1.

The special causes of *chylous effusion* into the pleural sacs are (*a*) those leading to the escape of chyle as the result of injury or disease of the vessels, namely, external violence, 8; carcinoma of the pleura, 5; occlusion of the left subclavian vein, 4; compression of the duct by tumor, 2; malignant lymphoma, 2; disease of the lymphatic vessels, sclerosis, lymphangiectasis, 2; occlusion of the thoracic duct, 1; filariasis, 1; and excessive strain, 1; (*b*) the discharge of a chylous ascites into the pleural cavity by way of the lymph spaces, 1.

Rotmann groups the causes of *chyliform effusions* into the pleuræ as (*a*) the presence of cells that have undergone fatty degeneration, as in carcinoma of the pleura, 5; tuberculous pleurisy, 3; non-tuberculous exudative pleurisy, 3; abscess of the lung, 1; and (*b*) abnormal fat in the blood—lipæmia.

The two cases of fatty effusion into the pericardium in the series he attributes to rupture of chylous vessels (?) and the discharge of chyliform fluid from the left pleura by way of the anastomotic lymph channels. In 25 of the cases no satisfactory cause could be determined.

It is obvious from a review of the above facts that in a considerable proportion of the cases the causal conditions are such as to produce both chylous and chyliform products, and the conclusion is inevitable that both these factors must be present in many milky effusions, and that such fluids are often mixtures in varying proportions of transudates and exudates.

The chemical and morphological characters of milk-like effusions have been especially studied by Mutermilch. The investigations of this observer were conducted upon the fluid obtained by puncture in the case of a child aged five months, in whom a right-sided pleural effusion followed a fall from the mother's bed.

The quantity of the fluid withdrawn was 115 c.c. It presented the following characteristics:

A complete resemblance to milk; opaqueness; absence of odor; whitish color, with a faintly yellowish or creamy shade; feeble alkalinity; specific gravity, 1017. Upon microscopic examination there were seen great numbers of minute, dust-like granules in active, molecular movement. Here and there were slightly larger bodies, constituting distinct points scattered separately or in groups; a few leukocytes; larger cells containing distinct, highly refractive granules and erythrocytes in very small numbers, and only found upon careful search.

The chemical examination, conducted upon the hypothesis that the fluid was a fat emulsion, yielded the following results:

Shaken with ether in a test-tube the fluid became less opaque. When a few drops of potassium hydroxide were previously added it became quite transparent and almost colorless. Upon the addition of osmic acid the fluid became blackish.

Microscopically, upon the addition of a 1 per cent. solution of osmic acid to a drop of the fluid, the dust-like granules assumed a dark-gray color. The same change in color was observed in the granules in the large cells. Upon the addition of ether the dust-like granules were dissolved. They ran together and formed at first smaller, then progressively larger, and finally quite large, highly refracting globules, which, upon treatment with osmic acid solution, became black in color.

The fluid, upon standing, deposited upon the bottom of the vessel grayish-red, flocculent masses, in which were to be seen under the microscope the above-described morphological elements.

The morphological elements were almost exclusively leukocytes and in marked preponderance lymphocytes. There were present in small numbers neutrophilic leukocytes containing fat granules, together with endothelial cells and a very few red blood corpuscles.

The chemical examination yielded the following results—100 c.c. of the fluid:

Solids	8.360
Albumin	6.135
Extractives by ether	1.481
Cholesterin	0.174
Soluble salts	0.563
Insoluble salts	0.028
Extractives by water	0.182
Extractives by alcohol	0.121

The fluid was absolutely sterile; neither microscopically nor by culture upon bouillon and agar were any micro-organisms to be recognized.

The above characters of the effusion in Mutermilch's case, considered in connection with the etiology of the condition—traumatism—and the entire absence of symptoms suggestive of pleural inflammation, justified the conclusion that the fluid consisted of chyle.

Quincke was the first to divide the fatty effusions into two groups: First, those consisting of chyle from the thoracic duct, or the lacteals —transudates—and, second, those resulting from fatty metamorphosis of the cellular elements in inflammatory effusions—exudates. It was generally thought that these two forms of milky fluid could be differentiated only by the microscope. Quincke described a case in which there was escape of chyle into the pleural cavity. The fluid was like milk, with a slightly yellow shade. Under the microscope it showed minute granules of different size, but all in the form of apparently round points, or dust particles, and a very small number of white blood corpuscles.

In contrast to this chylous effusion he described the form of fatty fluid resulting from fatty changes in the morphological elements. The fluid was bright yellow, somewhat cloudy, whey-like. Upon standing there formed upon the surface a thin, cream-like layer, showing under the microscope small globules, mostly in the form of collections of highly refractive granules, less frequently having sharp borders, and still less frequently presenting the appearance of large, indistinct nuclei. In the fluid underlying this layer were seen white blood corpuscles and larger round cells, which, in consequence of differences in the amount of fat, presented all possible transition forms. In this case Quincke ascribed the presence of the fat to the breaking down of cellular elements. He designated the effusions of the first category as hydrops chylosus; those of the second category as hydrops adiposus.

In 1885 Senator[1] adopted Quincke's division of the fatty effusions into hydrops chylosus and hydrops adiposus. Since the cases in the second category result from the fatty metamorphosis of endothelial and other cellular elements, and the diagnosis rests upon the presence of cells in which the fatty changes are incomplete, it is obvious that in advanced cases, in which the transitional forms may not be found, the diagnosis of the nature of the effusion must remain obscure. For this reason Senator ascribed great importance to the chemical study of these fluids, and especially to the presence of grape sugar, holding that chyle and lymph contain sugar constantly in quantities which may be easily recognized, while this substance is only found in serous transudates and exudates in non-diabetics exceptionally and in traces. Grape sugar, in more than doubtful traces, was believed by this author to indicate the presence of chyle. Later investigations, especially those of Pascheles and Reichel,[2] Pickardt,[3] and Rotmann,[4] have established the fact that ordinary serous transudates and exudates often contain this substance in recognizable quantities, and that its presence in chyliform exudates may also be expected.

Strauss[4] was able to demonstrate the chylous nature of the fluid in fatty ascites by giving his patients a diet rich in fat, the administration of which was found to greatly increase the proportion of the fat in the peritoneal fluid. This observer regarded the rapid renewal of the fatty fluid having always the same peculiarities as indicating its chylous nature.

The milky effusions into the serous cavities do not always owe their characteristic appearance to fat. Micheli and Mattirolo[5] have described pseudochylous forms of ascites, and have satisfied themselves experimentally that in the cases which they had under observation the milky appearance arose from the presence of lecithin.

Dr. Edsall reported at the last meeting of the American Pediatric Society a case of Hodgkin's disease, not yet published, in which there was a non-fatty pleural effusion, the opacity being due to altered globulins.

The case about to be described, brought to me by Dr. Housekeeper, of Vandengrift, Pennsylvania, illustrates one of the more common forms of fatty effusion into the serous cavities. It may, I believe, be properly regarded as an example of that group of cases in which the effused fluids, though fatty, are neither chylous nor chyliform or chyloid, but a mixture of both. This opinion is based upon the following facts:

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[1] Charité-Annalen, 1885, p. 307.
[2] Wien. klin Wochenschr., 1896, No. 17.
[3] Berl. klin. Wochenschr., 1897, p. 844.
[4] Münch. med. Wochenschr., 1898, No. 6.
[5] Archives de physiol. norm. et patholog., 1886, p. 367.
[6] Wien. klin. Wochenschr., 1900, No. 3. p. 56.

1. The constant gross physical characters of the peritoneal fluid and that removed from the left pleural cavity upon repeated aspiration on several occasions at comparatively short intervals of time.
2. The practically identical microscopic and chemical characters of the two specimens of left pleural effusion examined by Dr. Kelly and obtained within a period of twelve days.
3. The presence in those fluids of fine dust-like granules in great numbers, and showing active molecular movement and lymphocytes, together with polynuclear neutrophiles, nuclei, and endothelial cells in various transitional stages of fatty change.
4. The different gross and microscopic characters of the fluid contained in the circumscribed right pleural effusion.
5. The underlying pathological conditions, namely: diffuse sarcoma of the retroperitoneal and thoracic lymph glands and inflammatory pleural changes.
6. The softened condition of the lymph glands in the neighborhood of the receptaculum chyli, and the fact that the walls of that structure could not be recognized upon careful search and the thinned walls of the thoracic duct, changes permitting the escape and transudation of chyle.
7. The inflammatory changes about the sarcomatous glands and the pleural inflammation, the source of proliferation of endothelial cells and serofibrinous and seropurulent exudate, with fatty changes in its cellular elements.

Sarcoma of retroperitoneal and thoracic lymph glands; fatty ascites discovered upon operation for hernia; double pleural effusion, fatty upon the left side and presenting upon repeated aspiration, at intervals extending over a period of many months, the same appearance; circumscribed and seropurulent upon the right side; microscopic and chemical notes on the fluids; autopsy.

Anamnesis.—A. M. B., female, aged thirty-five years, single, a teacher; admitted to private room in the German Hospital December 5, 1904.

Family history good; father living and well; mother died about the menopause from disease the nature of which is unknown to patient; only two brothers, who are living and in good health; no sister. No history of tuberculosis or malignant disease could be obtained.

The patient states that she had scarlet fever in childhood, but cannot tell whether or not she had the other diseases of childhood. She had a severe attack of tonsillitis at the age of fifteen, but always regarded herself as having good health until about three years ago. Until that period she had a good appetite and digestion and regular bowels. First menstruated at fourteen, and that function has been regularly and painlessly performed until the present time. Dates her illness from the appearance of a femoral hernia upon the right side in the spring of 1902. This speedily began to give trouble, which led to an operation shortly afterward. In reply to a note of inquiry which I wrote to her surgeon, Dr. J. J. Buchanan, of Pittsburg, I received the following reply: "I operated on Miss A. M. B. for the radical cure of a femoral hernia with irreducible omental contents, if I remember aright. The peritoneum contained a considerable quantity of free fluid which was opaque, milky, or deep straw color. I remember that she was turned on her side to allow it to flow out. Perhaps there was a pint or two. No tubercles were on the sac or presenting omentum. She had no fever before or after the operation. Her wound healed *per primam.*"

The fluid was thought to be that of a tuberculous peritonitis. I was unable to ascertain whether or not a systematic examination of it had been made.

The following autumn she began to be short of breath upon exertion and had during the winter four severe attacks of bronchitis. In July, 1903, she had another attack of bronchitis. In the intervals between these attacks she had occasional slight cough and little or no expectoration, but felt constantly oppressed and was very short of breath upon even moderate exertion. At the close of the last attack of bronchitis the presence of a left pleural effusion was recognized and paracentesis was performed and a quantity of fluid, milk-like in appearance, withdrawn. This operation has been repeated a number of times, in all, as follows:

1903. July	quantity withdrawn about	1000 c.c.
1904. July	" " "	1000 "
1904. October 1	" " "	2000 "
1904. October 15	" " "	2550 "
1904. November 1	" " "	2500 "
1904. December 2	" " "	2500 "

The fluid always presented the same appearance and corresponded, according to the patient, to that which was removed after she came under my observation, and is fully described in Dr. Kelly's report which follows. During this period the patient occasionally noticed a slight discharge of similar fluid from the scar in her thigh resulting from the operation for the radical cure of the hernia. Her urine has never been milky in appearance. About the time that the first aspiration of the chest was performed her cough ceased and has not recurred. She has had no chills, fever, night-sweats, headache, or pain. Two years ago she weighed 128 pounds. Her present weight is 108 pounds.

Status Præsens. A tall, slender, well-formed woman of good color, but slightly cyanotic on exertion. No dropsy or œdema; no cutaneous eruption. Temperature normal, at times slightly subnormal; chest somewhat flattened on both sides, but more upon the left than upon the right. Respiratory movement shallow, the excursus being much more limited upon the left than upon the right side. Respiration frequency while at rest 20, upon slight exertion rapidly increased to 30 to 36.

The impulse of the heart not well made out either upon inspection or palpation. It is interesting to note in view of the postmortem findings that careful palpation and auscultation failed to reveal any signs of a mitral stenosis. In the precordial area there was no thrill, nor was any murmur to be heard. There is accentuation of the second sound at the base, particularly in the pulmonary area. The pulse is small and of moderate tension. Its frequency varies in repose from 80 to 96.

The percussion resonance is clear on both sides anteriorly in the infraclavicular regions, with a slight tympanitic quality upon the left side. Below this it is impaired upon the right side and there is dulness below, with flatness at the base upon the left side. The percussion signs posteriorly correspond to those in front except that dulness (flatness) extends much higher and there is flat tympany at the upper part of the chest. There is partial obliteration of Traube's semilunar space.

Upon auscultation feeble vesicular and bronchovesicular respiration over the upper lobes, but no rales. At the right base posteriorly a few faint subcrepitant and crepitant rales, especially upon deep inspiration. Over the area of dulness on the left side absent breath sounds diminished vocal resonance. There is absence of vocal fremitus. No friction sounds except in a limited area at inner border of left scapula. The area of liver dulness not enlarged. Its lower border corresponds to the margin of the ribs in the midclavicular line and descends about two fingers' breadth upon full inspiration.

The lower border of splenic dulness is below the costal margin.

The abdomen is soft, elastic, and symmetrical. The presence of ascites cannot be made out.

Urine amber, acid, 1030; no albumin; no sugar; phosphates, epithelial cells, leukocytes, and bacteria. Amount measured 400 to 900 c.c. Some lost at stool.

Blood: hæmoglobin, 90 per cent.; erythrocytes, 6,325,000; leukocytes, 7200.

Repeated examination both by day and by night showed no filaria.

Operation December 19, 1904, by Dr. Deaver. A large portion of the thoracic fluid was removed with aspirator. An incision 12 cm. long was made parallel to and over the eighth rib, its median portion corresponding to the midscapular line. Rib exposed and intercostal vessels raised upward; a bone elevator placed under rib and about 5 cm. removed with lion-jawed forceps. A similar portion was excised from rib above. Intercostal vessels ligated. Thoracic cavity opened, a quantity of chyloid fluid evacuated with force. Not all the fluid was removed. A large rubber tube (short) was anchored in the incision with silk. Incision was closed up to the tube with catgut. Antiseptic dressing.

For a time after the operation the patient did well, the temperature remaining normal. Beginning upon the tenth day the temperature became irregular, at times reaching 102° or 103°, and falling again to normal. The patient became dyspnœic and somewhat cyanotic with rapid pulse, which upon January 1st became uncountable. Upon January 3d the temperature rose to 103°, and the patient gradually sank, dying at 5.30 A.M.

The following is Dr. Kelly's report of his examination of the fluid removed from the left pleura December 8, 1904:

The fluid quite resembles milk in ordinary appearance—being whitish or slightly yellowish, opaque, and odorless. Its specific gravity is 1017. It contains a considerable amount of albumin—roughly, about 4 per cent. It does not respond to the ordinary tests for sugar—copper solutions, phenylhydrazin, and fermentation tests. The addition of ether followed by vigorous agitation causes the fluid to clear somewhat; the previous addition of a few drops of potassium hydroxide causes it to become much clearer. The addition of osmic acid causes the fluid to become quite blackish. On standing sometime a slight fibrinous deposit settled at the bottom of the vessel, and a small layer resembling the cream that forms upon milk formed at the surface. After standing in stoppered test-tubes and flasks at room temperature for ten days and two weeks, and being in the mean time several times exposed to the air, the fluid appeared quite "sweet."

Microscopically the fluid consists of cells (the character of which will be discussed presently) and a very large number of the finest granules; occasionally a single or several larger granules are observed, but almost all are very fine, even dust-like. They exhibit considerable molecular movement. The addition of a few drops of 1 per cent. osmic acid solution to the microscopic preparation causes the free granules, as well as similar granules in the under-described cells, to become darkish, blackish-gray in color. The addition of ether results in solution of the granules and their confluence to form larger masses, which become discolored, blackened, on the addition of osmic acid.

In addition to these granules, the fluid contains a moderate number of cells, a differential count of which reveals the following: lymphocytes, 76 per cent.; large mononuclear cells, 22 per cent.; polynuclear neutrophiles, 2 per cent.

The lymphocytes conform in all particulars to the lymphocytes of the circulating blood, and the polynuclear neutrophiles are also readily recognized as identical with the predominating leukocyte of normal blood. The cells described as large mononuclear differ somewhat in appearance among themselves. A few of them resemble the lymphocytes, though they are larger; others recall the large mononuclear leukocyte of normal blood; but on account of the presence on the cells of granules resembling and behaving toward ether and osmic acid like the free granules of the fluid, of vacuolation, and of degenerative changes, it is impossible to say what some of these cells are. Other cells, however, are roundish in outline, vary somewhat in size, have a fairly large, usually eccentric nucleus; their protoplasm contains fatty granules and vacuoles; evidently they are desquamated endothelial cells.

Appropriate staining methods failed to reveal any bacteria in cover-slip preparations.

By culture methods a large unidentified, spore-bearing bacillus (probably contamination) was isolated.

The results of the examination of a second specimen of fluid received December 20th was identical with the foregoing (except that one portion was slightly pinkish, owing to the admixture of blood).

Almost daily examination of the blood (by day and by night) between December 8th and 20th failed to reveal filaria sanguinis hominis.

A specimen of the fluid was handed to Dr. Charles A. Fife, of the William Pepper Laboratory of Clinical Medicine, for chemical examination. He reports as follows: The fluid is faintly alkaline to litmus paper, but acid to phenolphthalein, requiring 20 c.c. of a one-tenth normal sodium hydroxide solution to neutralize 100 c.c. of the fluid. The specific gravity is 1016.4.[1] The fluid consists of 93.388 per cent. water and 6.61199 per cent. solids, of which 4.679 per cent. is albuminous (probably entirely serum albumin), 1.065 per cent. fats, and 0.5639 per cent. ash. The fluid after the removal of the fats and proteids reduces copper slightly, but does not respond to the phenylhydrazin sugar tests.

The following are the notes of the necropsy (No. 735), made by Dr. A. O. J. Kelly, January 3, 1905, six hours after death:

The body is that of a fairly well developed female subject with gracile bony development, slight musculature, and slight panniculus adiposus. The skin is pale; the nutrition poor. There is slight postmortem rigidity, but no postmortem lividity. In the right groin there is a linear scar (the result of an operation for femoral hernia). Posteriorly in the left thorax there is an opening into the pleura, a defect of a rib (due to resection), and a rubber tube draining the pleura. The preperitoneal adipose tissue is slight in amount. The thoracic and the abdominal viscera have their normal relations the one to the other. The left pleura is non-adherent, except for a small area on the diaphragmatic surface; it contains 200 c.c. of rather thick "milky" fluid; in general it is pale, cloudy, and thickened, being in some places from 2 to 3 mm. thick; and it is covered (both the parietal and the visceral layers) with a rather thick or viscid, whitish, opaque, "milky" exudate. The left lung is small and compressed, and weighs 400 gm. It is mottled, grayish-black in color, of increased consistency, contains less air than normally, and reveals slight hypostatic congestion. The section surface is smooth, moist, and glistening, pale grayish in color, and exudes considerable frothy fluid. The lung crepitates throughout, and contains no tubercles and no cavities. The bronchi contain some serous or mucous fluid; their mucous membrane is pale, their calibre normal, but about them and extending somewhat into the adjacent tissue, there is apparently a slight amount of peribronchial connective-tissue overgrowth. The right pleura is dull, cloudy, pale, thickened, and universally adherent. As far down as the fourth rib the adhesions are firm and quite obliterate the pleural cavity. Below the fourth rib the adhesions are not so firm, and instead of obliterating the pleural sac, give rise to the formation of sacculi containing fluid; between the inferior surface of the lung and the diaphragm there is a large collection of fluid displacing the lung upward, but the lung extends down dome-like over the fluid—its edges reaching well down anteriorly, laterally, and posteriorly. The pleura contains a total of 550 c.c. of fluid, which, although somewhat "milky," is more correctly dull grayish in color, opaque, and "thinner" than the fluid obtained from the left side. The right lung weighs 650 gm. It is mottled grayish-black in color, of increased consistency, contains less air than normally, and reveals slight hypostatic congestion. The section surface is smooth, moist, and glistening, pale grayish in color, and exudes considerable frothy fluid. The lung crepitates through, and contains no tubercles and no cavities. The bronchi contain some serous or mucous fluid; their mucous membrane is pale, their calibre normal, but about them and extending somewhat into the adjacent tissue there is apparently a slight amount of peribronchial connective-tissue overgrowth. A few of the peribronchial lymphatic glands are quite small, firm, and anthracotic, and reveal no deviations from the normal; the great majority of them, however, are much enlarged, some of them very much enlarged, pinkish in color, and softened—almost diffluent. The pericardium contains 30 c.c. of clear, amber-colored fluid, and is non-adherent throughout. The heart is dilated, somewhat rounded in shape, and weighs 230 gm. It, more especially the right side, contains considerable dark clotted blood. The left auricle, the right ventricle, and the right auricle are dilated, especially the right auricle. The mitral orifice is contracted, and the leaflets thickened, indurated, and shortened. The chordæ tendinæ are also thickened and shortened.

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[1] Determined by a more sensitive instrument than was used in the other examination.

The tricuspid orifice admits three fingers readily, and the valve leaflets are probably insufficient. The aortic and the pulmonary valves are normal. The left ventricle measures 8 to 13 mm. in thickness, the left auricle 2 to 4 mm., the right ventricle 5 to 8 mm., and the right auricle 1 to 2 mm. The heart is pale, brownish-red in color, and firm in consistency. The coronary arteries are normal. The arch of the aorta and the descending aorta are slightly thickened in patches. The œsophagus is normal. The omentum is normal in size and slightly fatty. The peritoneum is dull, cloudy, pale, and slightly thickened in places, especially the peritoneum of the anterior abdominal wall and that of the posterior peritoneal cavity toward the vertebræ near and extending into the pelvis. It is non-adherent throughout. It contains 1200 c.c. of grayish-white, opaque, "thin" fluid. The liver measure 27 x 18 x 5.5 cm., and weighs 1340 gm. It is normal in shape, of increased consistency, smooth on the surface, and has sharp edges. The section surface is smooth, glistening, and moist, mottled yellowish-brown (nutmeg) in color, and exudes an increased amount of blood. The gall-bladder is normal in size, contains fluid bile; the cystic, the hepatic, and the common bile-ducts are patulous. The spleen measures 11.5 x 6 x 2.5 cm., and weighs 90 gm. It is dark in color; the section surface is smooth; and the trabeculæ are slightly increased. The right kidney measures 10 x 5.5 x 3 cm., and weighs 130 gm. The capsule is slightly adherent, and when stripped leaves a slightly granular surface, dark in color. The kidney in general is of increased consistency. The cortex is 7 mm. in thickness. The left kidney measures 11 x 5.5 x 3 cm., and weighs 150 gm. It is similar to its fellow in appearance. Both ureters and both adrenals are normal. The urinary bladder and the external and the internal genitalia exhibit no deviations from the normal aside from the ovaries, which are slightly enlarged, whitish, firm, and cystic. The stomach is normal in size and position; its mucous membrane is slightly congested, especially on the posterior surface (postmortem). The entire intestinal tract appears normal. The pancreas is pale pinkish in color, quite firm, and exhibits no noteworthy deviations from the normal. The mesenteric glands are slightly enlarged, pinkish in color, and somewhat softened. The retroperitoneal glands, especially those just above the promontory of the sacrum, are much enlarged, quite red in color, and very soft, and many of them being quite diffluent; indeed, such is the softening and diffluence that it is impossible to distinguish gland from gland; higher up glands may be differentiated, but all are enlarged, softened, and red or pinkish in color. About the normal situation of the receptaculum chyli there are several enlarged glands scarcely to be differentiated from adjacent structures, but no receptaculum as a separate structure can be made out. Dissecting out the thoracic duct as high up as the clavicle no noteworthy change can be recognized—in particular it is not enlarged or thickened. The brain and the spinal cord are not examined.

Anatomical Diagnosis. Sarcoma of the mesenteric, retroperitoneal, and peribronchial glands; bilateral pleuritis with chyliform exudation; chyliform ascites; mitral stenosis and insufficiency; dilatation of the heart; slight sclerosis of the aorta; passive congestion, œdema, and cyanotic induration of the lungs; passive congestion of the liver, spleen, and kidneys.

The following is the result of the microscopic examinations:

The enlarged mesenteric, retroperitoneal, and peribronchial glands are the seat of a new-growth that has almost entirely replaced or destroyed the lymphadenoid tissue—to a varying degree, however, in different glands. The new-growth consists of elongated, for the most part, spindle-shaped cells, with ovoid, rather vesicular nuclei, that stain well. The cells are arranged parallel or almost parallel the one to the other, but they are collected in fasciculi that course in varying directions, whence longitudinal, transverse, and oblique sections of the fasciculi are encountered. In many places the fasciculi seem limited to the sinuses, being apparently surrounded by a layer of flat endothelium; but in many places such arrangement and limitation are altogether wanting, and there is no appearance that warrants one in stating positively that the cells have been derived from proliferating endothelium. But little or no intercellular substance is apparent (by the ordinary methods of staining). Bloodvessels are comparatively few; those present have thin walls, mostly endothelium only, and they course amidst encircling fasciculi of tumor cells. Many of the retroperitoneal glands, especially those near the promontory of the sacrum, exhibit moderate necrosis. The other glands exhibit no retrograde alteration.

The pleura of the left lung is markedly thickened, the thickening involving the subendothelial connective tissue, the endothelium itself being wanting. This thickening consists of a highly vascularized fibrocellular tissue, the proportion of cells and fibrillar intercellular tissue varying in different regions. In general toward the free edge of the pleura the cellular collection consists of young fibroblasts and the ordinary round cells of inflammation; and the changes here merge rather rapidly into the more ordinary changes of fibrinous and fibrinopurulent exudation—a thick layer of which covers the pleura. The pleura of the right lung exhibits the usual lesions of adhesive pleuritis with considerable round-cell infiltration. Throughout both lungs there is an unusual thickening of the alveolar walls, which, however, is not uniformly distributed; in regions where it is less marked, there is considerable distention of the intra-alveolar capillaries, but where the thickening is more marked the capillary distention is obscured or absent. The thickening consists of a fibrocellular tissue rich in cells with elongated nuclei that stain well. Most of it appears to be white fibrous tissue, but there is a considerable proportion of elastic tissue. In some places the cellular new-growth is excessive and completely obliterates the lumen of several adjacent alveoli. One receives the impression that here and there there is an unusual proliferation from one side of the wall of the alveolus into its lumen; in other regions, doubtless because of transverse section of such a polypoid growth, the new tissue reposes in or fills an alveolus without manifesting attachment to its wall. In addition to this connective-tissue overgrowth, many of the alveoli are more or less filled with an exudation consisting of leukocytes, desquamated epithelium, and a few erythrocytes. Many of the desquamated epithelial cells are excessively pigmented. This alveolar exudation is most marked just below the pleura of the left lung, where, together with the proliferation of the connective tissue of the alveolar walls, it gives rise to almost complete obliteration of the lumen of many alveoli.

The liver exhibits moderate dilatation of the central veins and adjacent capillaries, moderate pigmentation, and slight atrophy of the regional liver cells. The spleen exhibits considerable thickening of the trabeculæ, and considerable pigmentation—partly free and partly within the cells of the pulp. The kidneys exhibit moderate passive congestion and slight degeneration of the epithelium of the convoluted tubules. The uterus exhibits a slight grade of hyperplastic glandular endometritis. Otherwise there are no noteworthy microscopic alterations in the organs.

The fluid from the right pleural sac has a specific gravity of 1017. It contains 4 per cent. of albumin (Esbach). Microscopically there is considerable fibrin and a moderate number of cells, but none, or very few, of the fine granules observed in the fluid obtained by puncture from the left pleura during the life of the patient. A differential count of the cells reveals the following: lymphocytes, 58 per cent.; large mononuclear cells, 25 per cent.; polynuclear neutrophiles, 17 per cent. The lymphocytes and the polynuclear neutrophiles are readily identified. Some of the large mononuclear cells are doubtless degenerated lymphocytes, but the majority appear to be more or less degenerated and vacuolated endothelial cells.

The fluid obtained from the peritoneum has a specific gravity of 1016. It contains 3.5 per cent. of albumin (Esbach). Microscopically there is a moderate number of cells, and a large number of granules identical with those obtained from the left pleura. The granules are free and also contained within certain of the cells. They stain blackish with osmic acid, and are dissolved with ether. A differential count of the cells reveals the following: lymphocytes, 70 per cent.; large mononuclear cells, 29 per cent.; polynuclear neutrophiles, 1 per cent. The large mononuclear cells are similar to those found in the fluid from the left pleura, though they differ among themselves. Many of them contain fine granules that are dissolved by ether, and stain black with osmic acid. They are doubtless desquamated endothelial cells.

Cultures from the right pleura and from the left pleura revealed staphylococcus pyogenes albus and aureus. Cultures from the peritoneal fluid revealed bacterium coli communis.

Within five hours of making the necropsy I inoculated three rabbits subcutaneously (in the William Pepper Laboratory of Clinical Medicine) with an emulsion of the softened retroperitoneal glands. One rabbit died the following day from peritonitis due to puncture of the intestine with the inoculating needle. The other two rabbits lived in excellent health, and were finally killed on April 6, 1905. No lesions were found at the necropsy.

REPORT OF A CASE OF METASTATIC ENDOTHELIOMA.

By Edward Jenner Wood, S.B., M.D.,
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The patient was a white man, aged forty-three years. His occupation was that of a salesman. There was nothing in his family history of any note except that his father died of carcinoma of the œsophagus, and a brother died of a complication of cardiac and renal affections. There was nothing in his previous medical or surgical history of any importance until the year 1900. During that year he noticed a small nodular mass on the surface of the right testicle. The testicle became painful and began to increase in size. It was firm in consistence and showed no sign of breaking down in any part of it. This condition gradually increased until the final removal of the testicle. In the opinion of the surgeon the growth was sarcomatous.

After a lapse of over two years, in 1902, the patient felt the presence in the remaining testicle of the same symptoms that formerly had attracted his attention—namely, the nodule of the size of a buckshot, the increase in consistence, the swelling, and the pain. Again he was advised to have the radical operation performed, which he consented to. In this instance the histological examination was made by a competent pathologist, who pronounced it a large round-cell sarcoma.

Following this second operation the patient's health improved, though he was never robust. In September, 1904, following a fall, he began to complain of backache. Seldom was he free from pain, which usually was of the dull, boring character, though at times it was of the stabbing variety. The patient thought that this more severe pain was relieved coincidentally with the voiding of his urine.